Contribution ID: **811** Contribution code: **THPM008** Type: **Poster Presentation**

Virtual temperature measurements of ferrite in in-vacuum kicker magnets

Thursday 5 June 2025 15:30 (2 hours)

The Large Hadron Collider (LHC) Injector Upgrade project has achieved unprecedented beam brightness levels, to fulfill the High Luminosity LHC requirements. This higher intensity has introduced significant challenges for some of the Super Proton Synchrotron (SPS) kickers, specifically concerning beam-induced heating and vacuum rise due to electron cloud.
The primary concern is the integrity of the ferrite within the kicker magnets, which is critical to the system's operation and availability. Currently, temperature monitoring relies on temperature probes (PT100) installed on the magnet's frame, but these do not provide direct measurements of ferrite temperature. To address this limitation, we present a method using deep learning techniques to develop a virtual temperature sensor, enabling real-time monitoring of ferrite temperatures across the kicker module. We apply this approach to some of the SPS injection kicker family, the so-called MKP-S, and discuss the general applicability of the method to other systems.

Footnotes

Paper preparation format

LaTeX

Region represented

Europe

Funding Agency

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Session Classification: Thursday Poster Session

Track Classification: MC6: Beam Instrumentation and Controls,Feedback and Operational Aspects: MC6.D13 Machine Learning